Claims

We claim:

1. An optical scanner for scanning a fluorescent sample associated with a sample container, said scanner comprising:

at least one laser producing an illumination beam;

an illumination focus lens, focusing said illumination into a beam spot said beam spot targeted on the fluorescent sample;

a reflective light collector positioned proximate to said sample container and in a path of said illumination beam that collects light from a collector focus and reflects collected light as a collimated emission beam, wherein said light is reflected at an angle in relation to an optical axis of said illumination beam, said light collector having a hole that allows said illumination beam to pass through said reflective light collector; and

light detection optics, said light detection optics detecting the intensity of said emission beam.

2. The optical scanner of claim 1, further comprising:

a beam scanner that moves the beam spot in a scan through a layer in said container;

a spatial filter placed in the emission beam said spatial filter transmitting a portion of said focused emission light;

a detection lens positioned in the path of the collimated emission beam between said light collector and said spatial filter, wherein the detection lens focuses collimated light through the spatial filter.

3. The optical scanner of claim 1, wherein said illumination focus lens is an expander/contractor lens allowing shaping of the illumination beam spot size.

4. The optical scanner of claim 1, wherein said illumination focus lens is achromatic.

5. The optical scanner of claim 1, wherein said reflective light collector is paraboloid mirror.

6. The optical scanner of claim 5, wherein said paraboloid mirror has a hole through which the illumination beam may pass.

7. The optical scanner of claim 2, wherein said beam scanner includes a stage that translates the sample container in two dimensions.

8. The optical scanner of claim 2, wherein said beam scanner includes a scan head comprised of platform onto which said reflective light collector is mounted, a track supporting said platform and an actuator that drives the platform on the track.

9. The scanner of claim 8, further comprising a stage for holding the sample container, said stage translating the container in a direction tangent to a beam scan direction.

10. The optical scanner of claim 2, wherein said spatial filter is provided by an optical fiber end.

11. The optical scanner of claim 2, wherein said spatial filter includes an aperture.

12. The optical scanner of claim 1, further comprising an electronic memory for storing detection intensity measurements.

13. The optical scanner of claim 1, wherein said light detection optics includes a beam splitter and at least two light detectors, wherein the beam splitter directs the emission wavelengths above a threshold wavelength to a first light intensity detector and wavelengths below a threshold wavelength to a second light intensity detector.

14. The optical scanner of claim 13, wherein said light intensity detector is a photomultiplier tube.

15. The optical scanner of claim 1, wherein the depth of detection is limited to a depth of field between 1 and 500 nm.

16. The optical scanner of claim 15, wherein the reflective light collector has a focus point within said beam spot.

17. The optical scanner of claim 1, further comprising a beam splitter placed in the path of the illumination beam and diverting a portion of the illumination beam and a power monitor positioned in the path of the diverted illumination beam.

18. The optical scanner of claim 1, wherein at least one laser comprises a first and a second laser and a reflective beam combining optic, said beam combining optic merging laser beams from said first and second laser into a single illumination beam.

19. The optical scanner of claim 18, further comprising a first and a second shutter placed in front of each laser beam from said first and second laser.

20. A method to optically interrogate a sample having discrete, optically detectable targets the method comprising:

directing a focused laser light beam onto said sample;

moving said focused laser light in relation to said sample such that a waist of said focused laser light moves through an area of said sample;

collecting fluorescent emission with a reflective light collector, said light collector having a focal depth, said light collector collimating said collected light into a collimated emission beam; which is directed to an angle relative to the emission beam to detection optics; and

measuring an intensity of the collected emission light.

21. The method of claim 20, further including focusing said collimated emission beam through a spatial filter having an aperture through which a percentage of impinging light may pass, said spatial filter limiting the depth of field to a selected depth.

22. The method of claim 20, wherein said sample is a homogenous assay mixture.

23. The method of claim 20, further comprising prior to moving said focused laser light, focusing a beam waist of said focused laser light onto a defined layer in said sample.

24. The method of claim 20, wherein collecting light with a reflective light collector includes collecting light with a parabolic mirror.

25. The method of claim 20, further comprising analyzing the intensity of collected emission light to identify discrete optically detectable targets.

26. The method of claim 21, wherein focusing said collected light through an optical device having an aperture includes focusing said collected light into an optical fiber.

27. The method of claim 21, wherein focusing said collected light through an optical device having an aperture includes focusing said collected light through a pinhole aperture in a spatial filter.